

“Physicist Resource Survey”

Two pronged attack:

Survey of experiments’

“needs”

Survey of NSF/DOE grants

under constant effort instruction

HEPAP Meeting
March 4, 2006
Jim Whitmore
(for Chip Brock)

Outline:

introduction to the project

results

conclusions

In July 2004, a task force was formed by HEPAP to investigate

- *the projected “needs” of experiments and*
- *“plans” for all US HEP groups*

“Does the field have the manpower to carry out the experiments to which program is committed until the end of the decade?”

A survey was conducted (Sept. 04 – June 05) among two communities:

- *spokespersons of a committee-selected set of experiments*
- *all DOE HEP and NSF EPP experimental PI’s*

For the experiments:

- *evaluate their **needs** in operations (carefully defined) and analysis (carefully defined) from 2004-2009 for: faculty/staff, post docs, students*

treating 2004 as a census year, only then, breaking out foreign and US

For the PI’s:

- *evaluate their **plans** for: faculty, research scientists, post docs, graduate students for all projects from 2004-2009*

under a severe, constant effort boundary condition

Committee:

- *Joel Butler, Sekhar Chivukula, Glen Crawford, Howard Gordon, Young-Kee Kim, Usha Mallik, John Womersley, Bill Molzon. Chairs: Jim Whitmore and Chip Brock*

the actual charge from Fred Gilman, 17 July 2004:

Formation of a Working Group to Study HEP Manpower

Following the discussion at the last HEPAP meeting, a Working Group is being formed to assess the question: **Does the field have the manpower to carry out the experiments to which the U.S. program is committed until the end of the decade?** The members of the Working Group will be drawn from both the HEP community and the agencies, DOE and NSF.

To answer the question at hand, **each university and laboratory group** will be requested to give its plan for the distribution of faculty/staff/postdocs/students among the various projects with which they are involved for each year through 2009. The funding assumption is **constant level of effort**, starting with 2004 as the base year.

These data will be compared with those supplied by the **relevant collaborations**, who will each be asked for their **minimum year-by-year manpower needs**. In addition, for on-shore experiments, their **year-by-year expected U.S. and non-U.S. contributions will be requested**.

An initial report from the Working Group was presented to HEPAP at its meeting on September 23-24, 2004. (Final Report in June 2005.)

We gave the written report to R. Staffin and J. Dehmer and M. Shochet on January 31, 2006. (The Feb 17, 2006 version has a minor addition.)

August/September 2004:

- *Committee jointly prepared*
letters of introduction and instructions plus spreadsheets, including fictional examples
- *They were sent to:*
All NSF experimental EPP grant PI's, including CESR
All DOE HEP grant PI's, including FNAL, BNL, SLAC, ANL, LBL, MITLNS
Spokespersons (SP) of 18 selected experiments

September 2004 through April 2005:

- *reminding, cajoling, begging, threatening PI's and spokespeople to respond*
Eventually, nearly 100% of PI's responded in a useful way
All experiments replied
- *updates were given at each HEPAP meeting through final report, July 2005*

Data analysis

- 18 spreadsheets from the experiments
- 194 spreadsheets from all PI's - combined into one 50,000 cell db
 - hand-checked automated process...no errors

Subsequent discussions centered on the Tevatron experiments

- *Previews with CDF/DØ in near-parallel fashion, with consent of comm.*

Brock attended the DØ Institutional Board meeting at Vancouver on 6/14

- *showed experiment plus DØ-only PI results*

Brock prepared parallel talk delivered by Kim to CDF Executive Board on 6/23

- *showed experiment plus CDF-only PI results*

Both institutional representative groups were sent a questionnaire as follow-up to their groups' survey results

- *FNAL Aspen PAC*

Whitmore attended and presented the same information to PAC

- *Committee met electronically to discuss results and fashion conclusions*

Endgame

- *Final results presented to HEPAP on July 12, 2005*
- *Final write-up was finished in January 2006*

PI response from universities and laboratories

Both PIs and SPs were sent essentially identical letters

- *PI:*

“To help us address this important issue, please provide us with the following information *under the assumption that your funding will correspond to a constant level of effort starting in FY2004 and going through FY2009*. Partly as a result of this study, we will learn whether this is an acceptable assumption or not, but please use it for answering this survey.”

- 1) For this survey, we are only interested in personnel who appear in the mastheads of publications and contribute to the maintenance, operations and/or analysis of experiments. Definitions of FTE for
 - Faculty (Fac): enter the fraction of the person's RESEARCH time;
 - Research Scientist (RS): enter the fraction of the person's TOTAL time;
 - Postdoc (PD): enter the fraction of the person's TOTAL time (realizing that part of their activities will likely be data analysis);
 - Graduate Student (GS): enter the fraction of the person's TOTAL time (realizing that part of their activities will likely be data analysis);
- 2) IF you have strong reasons to change the assumption of constant level of effort (eg a new faculty member coming in a particular year), please state your reasons.
- 3) Note that the first year of this survey is an accounting of your current effort and as such are presumably precise numbers. Since the strategy for the survey is “constant effort,” the sum of each category of personnel is expected to remain equal to the FY2004 totals (although see note 4) through the FY2005-2009 period. Please estimate the split among projects with the realization that the accuracy may only be at the level of 0.5 FTE.
- 4) Since there may be cases where you wish to change FTEs between categories, for this study please use the following conversions: 2 postdocs = 1 Research Scientist or 1 other; and 2 graduate students = 1 postdoc. While these are not intended as direct financial equivalents, they may be useful guides for converting effort between classes of individuals.

This was completed for:

194 groups

81 NSF supported

136 DOE supported

a number with both sources

53 projects with ≥ 2 PI's responding

603 group-projects

$\Rightarrow \sim 3$ projects per group

Including, for 2004:

717 total faculty

340 research scientists

547 PD

712 GS

by resource
(faculty, RS, PS,
GS) and by project
(experiment)

note:

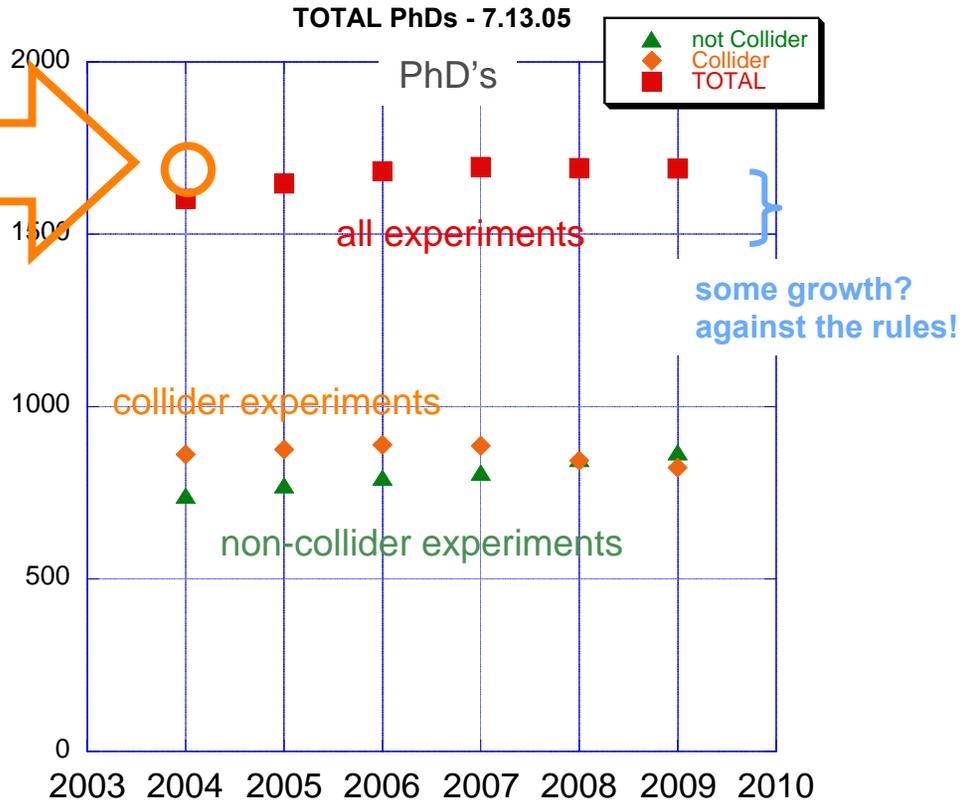
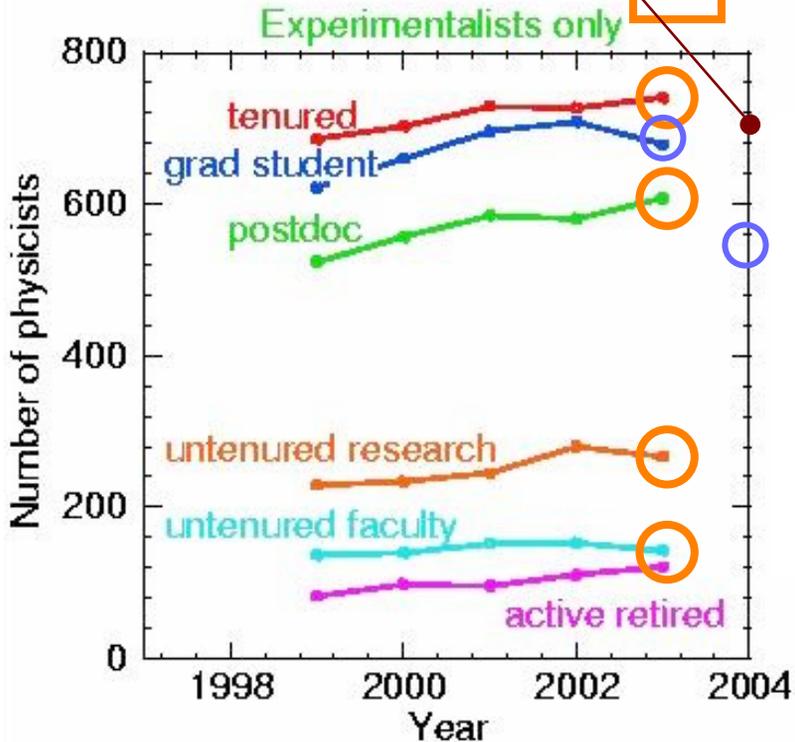
Hand checking done for CDF and DØ spreadsheets

1	Institution:						
	Contact Person:						
	Funding agency(ies)						
	Projects working on between now (FY2004) and FY2009 (A, B,):						
	A						
	B						
	C						
	D						
2	Numbers of current personnel in each category	Funded in FY04 from base	Funded in FY04 from off-base	Type of person			
	Faculty						
	Research scientists						
	Postdocs						
	Graduate Students						
	Others (identify type of person)						
3	Estimated number of FTE personnel working on each project in each category in each year (only from base funding):						
	Faculty	FY2004	2005	2006	2007	2008	2009
	Project A						
	Project B						
	Project C						
	Project D						
	Sums	0.0	0.0	0.0	0.0	0.0	0.0
	Research Scientists	FY2004	2005	2006	2007	2008	2009
	Project A						
	Project B						
	Project C						
	Project D						
	Sums	0.0	0.0	0.0	0.0	0.0	0.0
	Postdocs	FY2004	2005	2006	2007	2008	2009
	Project A						
	Project B						
	Project C						
	Project D						
	Sums	0.0	0.0	0.0	0.0	0.0	0.0
	Graduate students	FY2004	2005	2006	2007	2008	2009
	Project A						
	Project B						
	Project C						
	Project D						
	Sums	0.0	0.0	0.0	0.0	0.0	0.0

□ Ph.D totals from the PI's: does it make sense?

survey GS: 712

from the pdg census:



note:

- collider-non-collider about equal
- some "illegal" growth assumed by PI's
- we consider this a validation to $\pm 10\%$

Counting faculty seems to be a tricky business

- *Their time-fractions are inherently complicated and time-dependent*
- *We used % of Research Fraction - “RF”*

this allowed for a variety of comparisons and easy checking that the constant-effort rule was followed...since it sums to a name

But: RF overcounts FTE

- *Experiments use FTE*

for postdocs and graduate students, essentially FTE = RF

Standard in experiments is a 50% efficiency factor for faculty time

For laboratory scientific staff, RF considerably higher than 50%

- *A scaling: use an estimated FTE (“ESTFTE”) for faculty counting*

“ESTFTE” = 0.5*(university professor RF)+(laboratory scientific staff RF)

Plots will indicate either “FTE” or “ESTFTE” where appropriate

Correlations:

- *PD and GS counting totally correlated to faculty involvement*

e.g., a 20% faculty person implies at least 1 student and/or 1 postdoc

while...a 0% FTE faculty person—implies zero

Spokespersons' response from experiments

experiments' NEEDS: DAQ

Requested responses from 18 experiments:

- DØ
- CDF
- BaBar
- Minos
- BTeV
- CLEO
- MECO
- KOPIO
- MiniBooNE
- SUPER K
- ATLAS
- CMS
- SNAP
- STACEE
- VERITAS
- LIGO
- AUGER
- MINERvA

2004 is a special reporting year: a census within function (Operations/Analysis), within resource (faculty/staff, PD, GS), and within nationality (US, non-US)

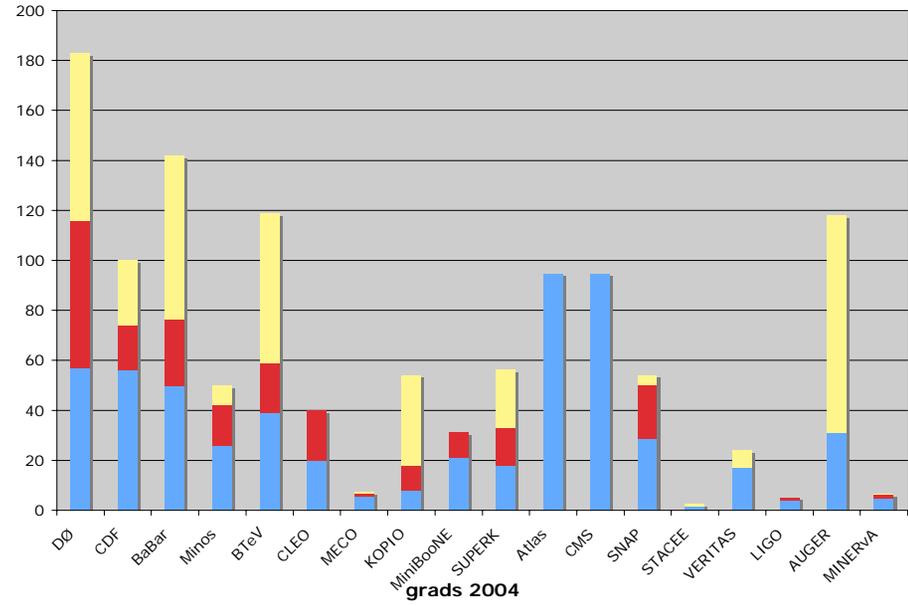
n.b. in what comes: occasionally US outyear effort is estimated by scaling from the 2004 US/total fraction

outyears: only totals

A	B	C	D	E	F					
EXP	A									
Responder	your name (yourname@expA.lab)									
date	9/1/04									
ACTUAL	Personnel	FY 04	NEEDED	Personnel	FY 05	FY 06	FY 07	FY 08	FY 09	
operations	FTE Fac-US institutions	0	operations	TOTAL FTE Fac	5	5				
	FTE host lab staff	5								
	FTE Fac/staff foreign institutes	0								
operations	FTE PD-US institution	7	operations	TOTAL FTE PD	12	8.5				
	FTE PD-host lab	0								
	FTE PD-foreign institutes	3								
operations	FTE GS-US institution	5	operations	TOTAL FTE GS	10	10				
	FTE GS-foreign institutes	5								
	TOTAL OPERATIONS	25		TOTAL OPERATIONS expected precision ±10%	27	23.5	0	0	0	
analysis	FTE Fac-US institutions	25	analysis	TOTAL FTE Fac	40	40				
	FTE host lab physics staff	5								
	FTE Fac/staff foreign institutes	10								
analysis	FTE PD-US institution	7	analysis	TOTAL FTE PD	10	10				
	FTE PD-host lab	0								
	FTE PD-foreign institutes	3								
analysis	FTE GS-US institutions	10	analysis	TOTAL FTE GS	20	20				
	FTE GS-foreign institutes	10								
	TOTAL ANALYSIS	70		TOTAL ANALYSIS expected precision ±10%	70	70	0	0	0	
FTE checksum	total faculty/staff	45	FTE checksum	total faculty/staff	45	45	0	0	0	
FTE checksum	total PD	20	FTE checksum	total PD	22	18.5	0	0	0	
FTE checksum	total GS	30	FTE checksum	total GS	30	30	0	0	0	
major tasks: 2005	upgrade installation, which involves an increase in FTE post docs by 2									
major tasks: 2006	upgrade complete; calibration of new upgrade components									
major tasks: 2007 - 2009										
Any general comments: We are considering another future detector upgrade which might require more personnel.										

Spokespeople: total personnel, 2004

faculty/staff 2004

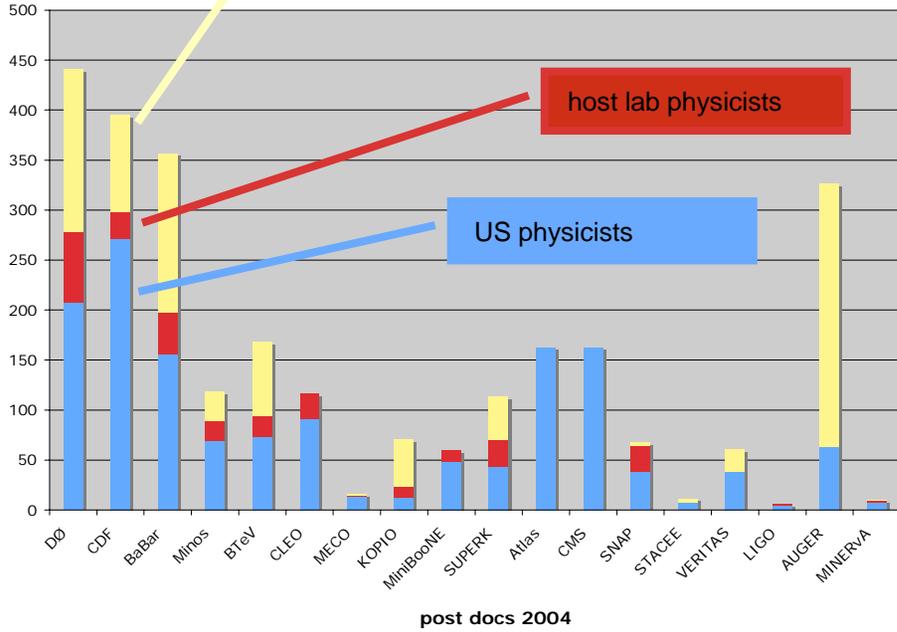


collaborations 2004

non-US institution physicists

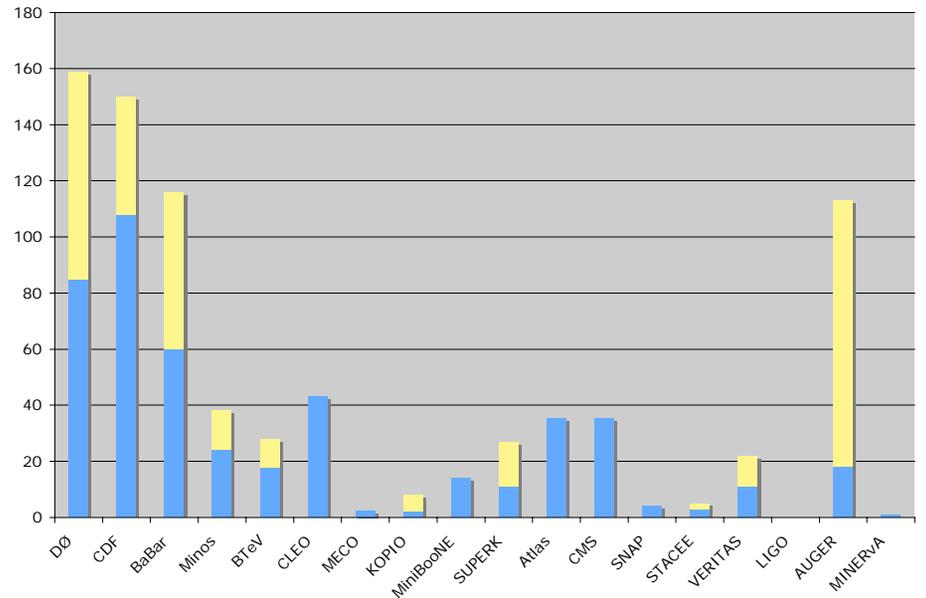
host lab physicists

US physicists



post docs 2004

grads 2004

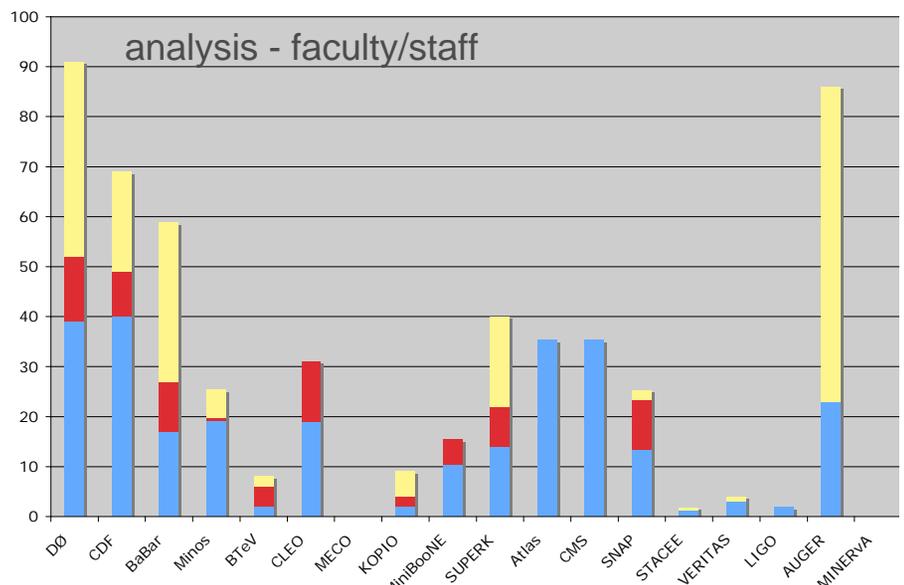
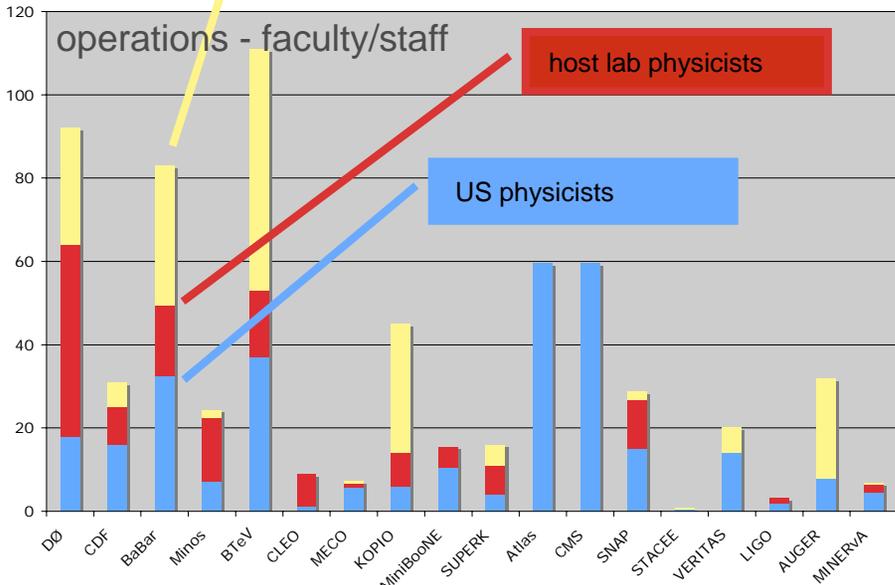


Spokespeople: operations and analysis, Ph.D's 2004

non-US Institution physicists

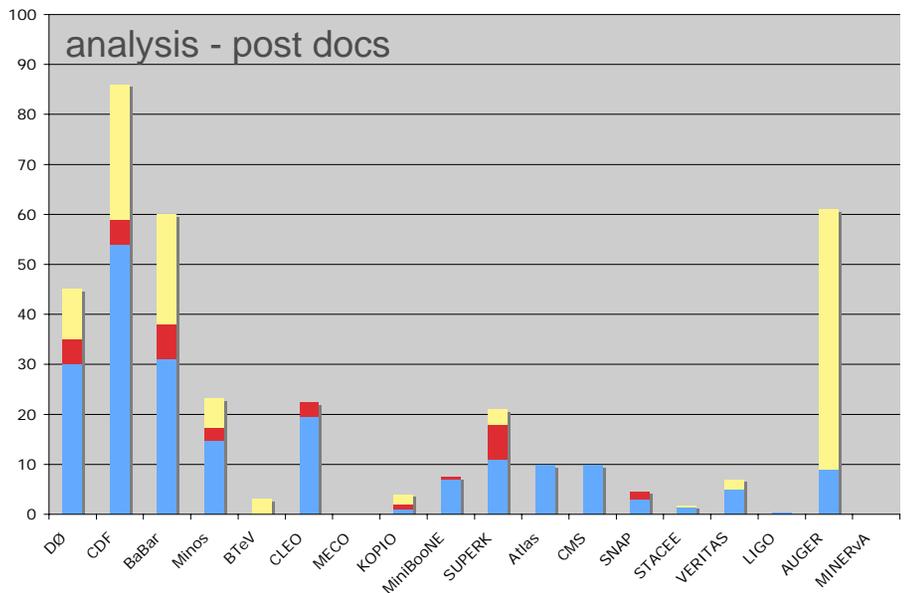
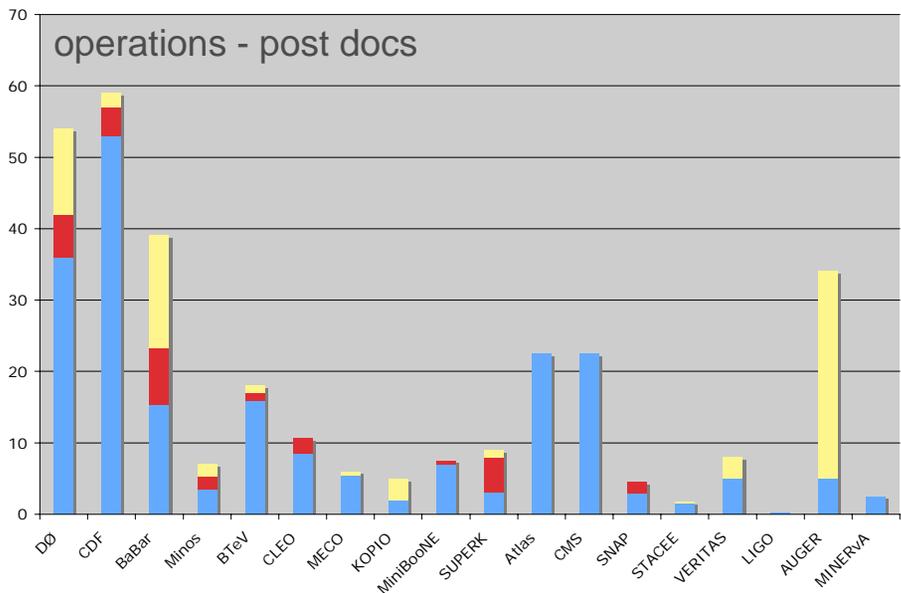
operations: faculty/staff 2004

analysis: faculty/staff 2004



operations: post docs 2004

analysis: post docs 2004

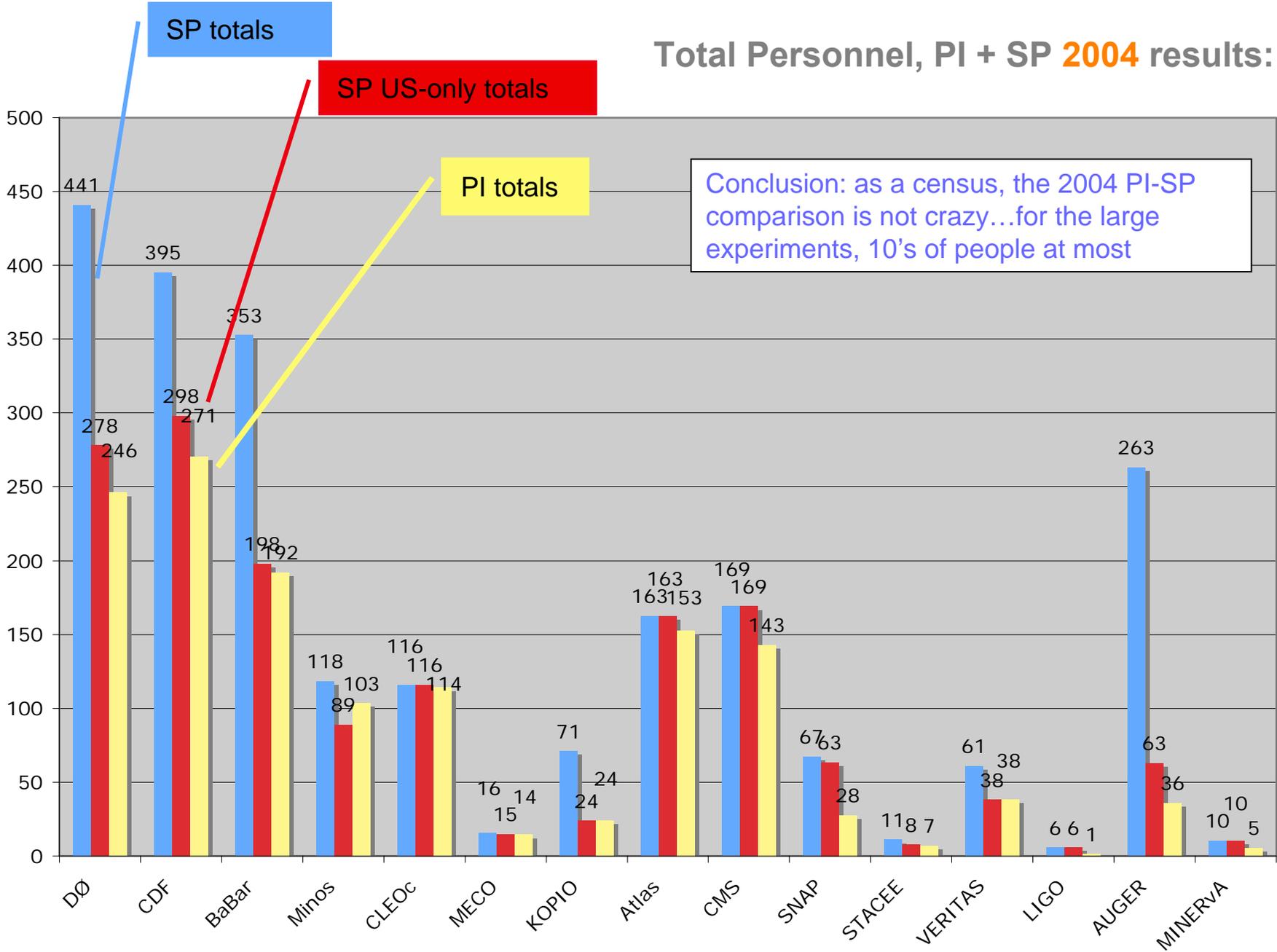


PI & experiment comparisons

In what follows:

- *Experiment plots are for **US personnel only***
scaled from the 2004 fraction to compare with US PI's - that's a model
- *Uncertainties:*
certainly $\pm 10\%$ for Ops
certainly larger for Analysis

Total Personnel, PI + SP 2004 results:



Conclusion: as a census, the 2004 PI-SP comparison is not crazy...for the large experiments, 10's of people at most

PI & experiment-”needs” comparisons

For running experiments

- *estimation of need*

is relatively straightforward for operating the experiments

- *estimate $\pm 10\%$ on operations uncertainties*

is considerably less so for analyzing the experiments

- *same people do both, sometimes at different times during their involvement*
- *analysis intensity follows the integrated luminosity jumps*

For future experiments

- *estimate is of something other than “need”*

reported as consisting of basically a mixture of

- *real effort now ongoing in construction (like operations in running exp), again $\pm 10\%$?*
- *plus a census of what groups intend to do in the future*

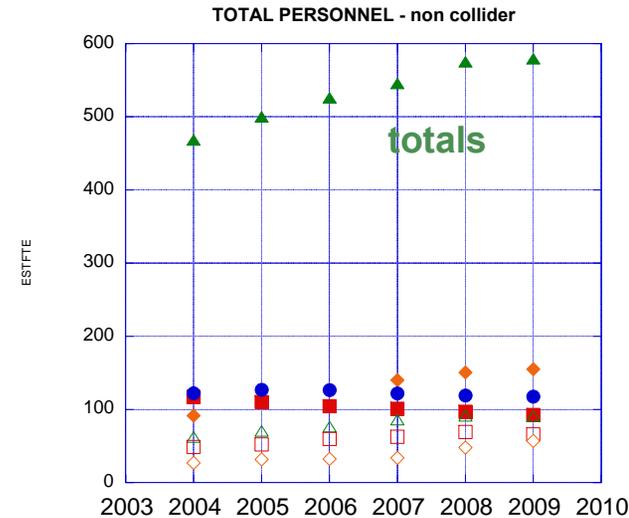
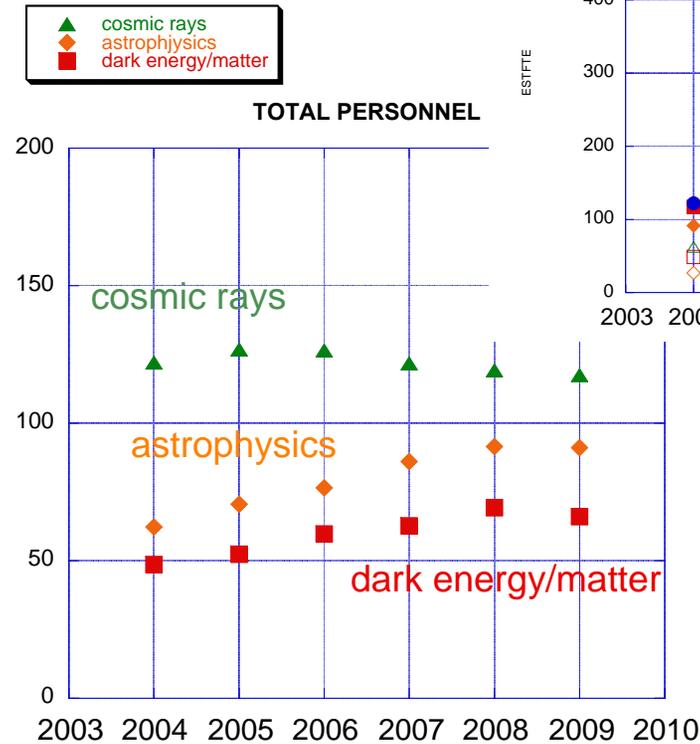
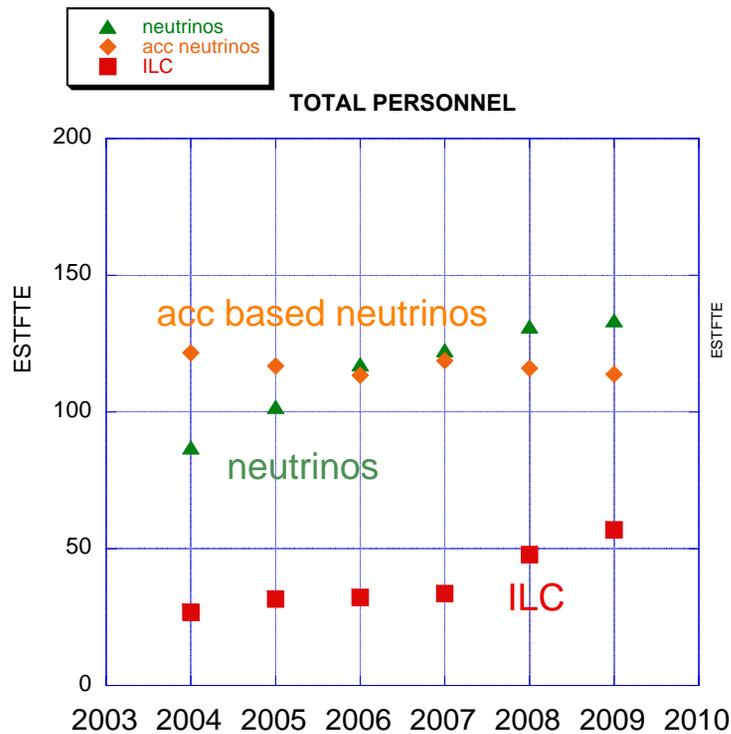
The point:

- *I’m trying to be sure that I do not use the word “need” for the LHC experiments*

What’s reported I’ll call “Anticipation” in what follows

all non-collider future and current programs reported by PI's

The PI database contains lots of information



“neutrinos,” such as: AMANDA, Double Chooz, IceCube, K2K, KamLand, SNO, SuperK, others...

“accelerator based neutrinos,” such as: MiniBooNE, MINOS, NOvA, T2K, Minerva, NuTeV

“cosmic rays,” such as: Auger, CACTUS, CHICOS, CREAM, CROP, FLASH, HiRes, Milagro, STACEE, VERITAS

“astrophysics,” such as: CMB, GLAST, LIGO, SDSS, SNAP

“dark energy/dark matter,” such as: CAST, CDMS, COUP, DES, DRIFT, eBubble, LSST, UNO, SuperCDMS, XENON, ZEPLIN II

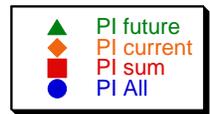
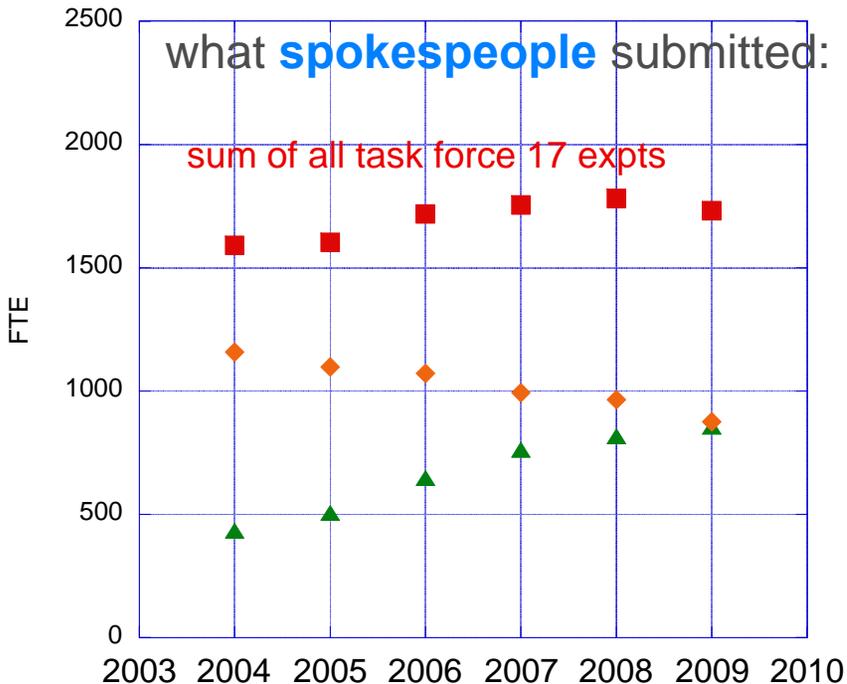
The entire survey of 17 (not BTeV) experiments, Spokespersons and PI's



Task Force (18-1) experiments

what **spokespeople** submitted:

sum of all task force 17 expts

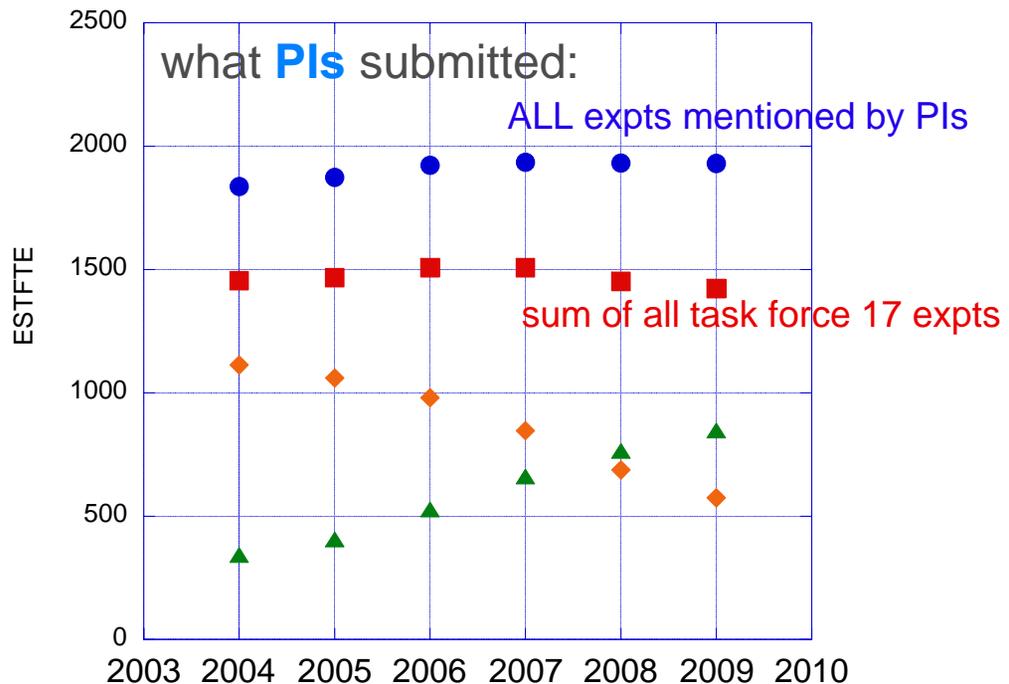


Task Force (18-1) experiments

what **PIs** submitted:

ALL expts mentioned by PIs

sum of all task force 17 expts



KEY:

current: DØ, CDF, BaBar, Minos, CLEO, MiniBooNE, SUPER K, STACEE, LIGO, AUGER, MINERvA

future: ATLAS, CMS, SNAP, MECO, KOPIO, VERITAS

“PI All” is for all experiments included in PI survey: the 17 plus all others

specifically the collider experiments

In what follows:

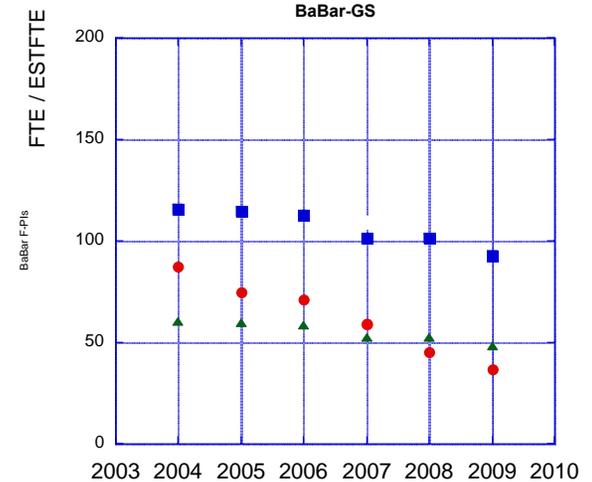
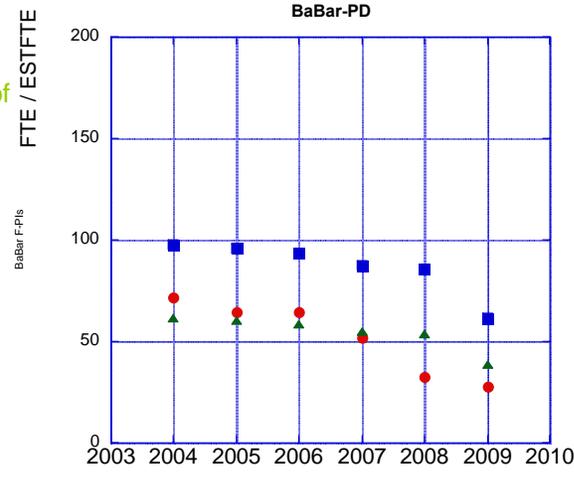
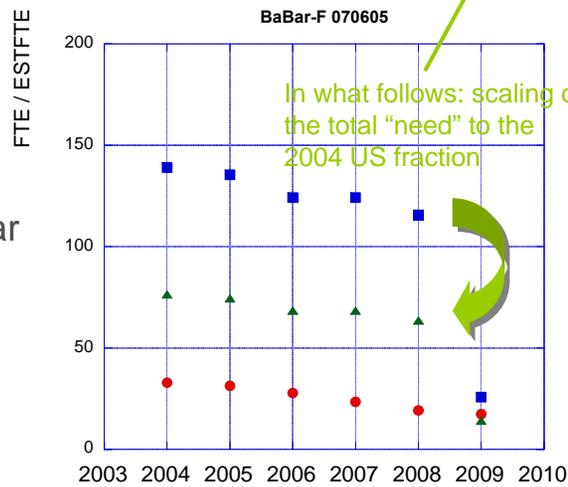
- *All Experiment plots are for **Operations plus Analysis***
- *All Experiment plots are for **US personnel only***
scaled from the 2004 fraction
- *Uncertainties:*
certainly $\pm 10\%$ for Ops
certainly larger for Analysis

BaBar, CLEO: total PI responses compared with Experiment Needs

■ total SP reported ▲ scaled to US-based SP

● US-based PI

BaBar

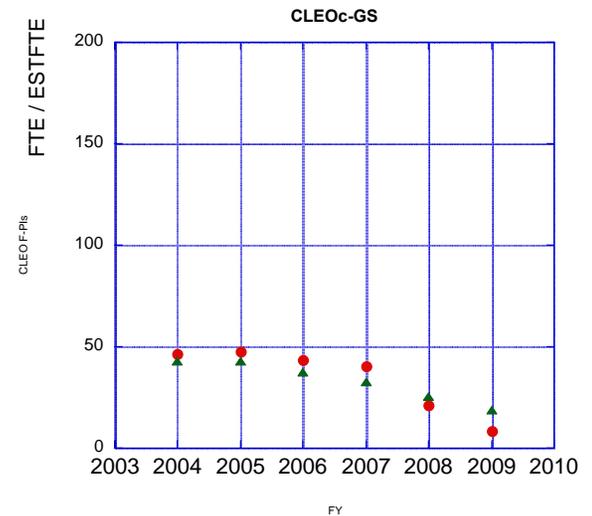
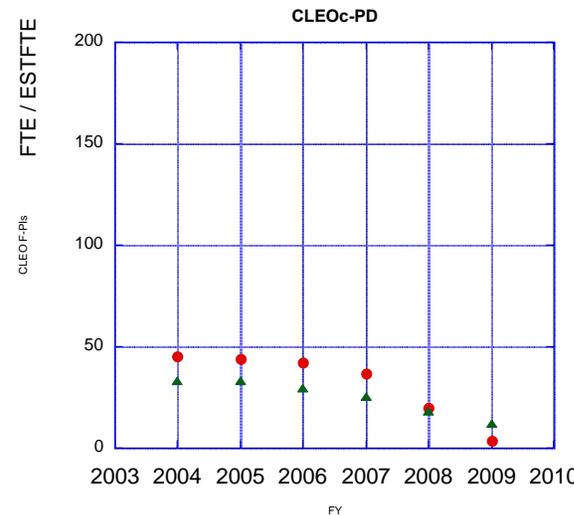
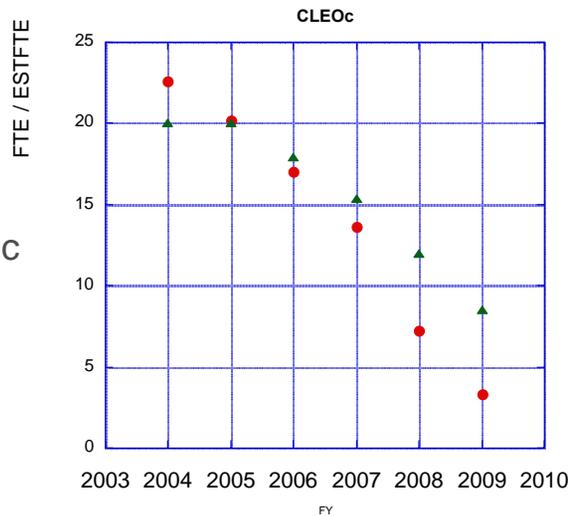


faculty/staff

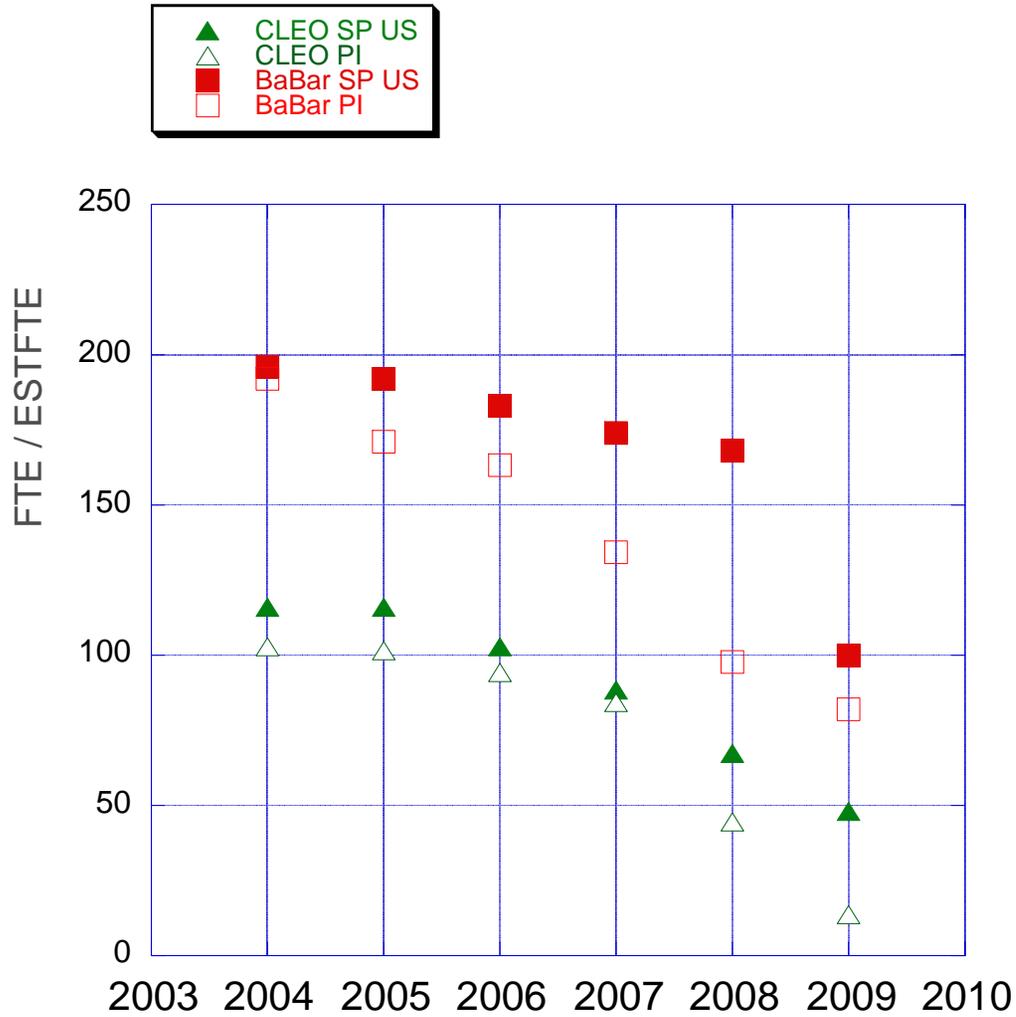
post docs

graduate students

CLEOc



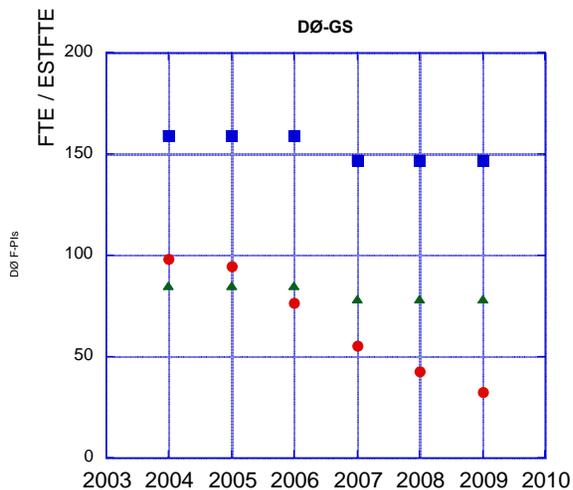
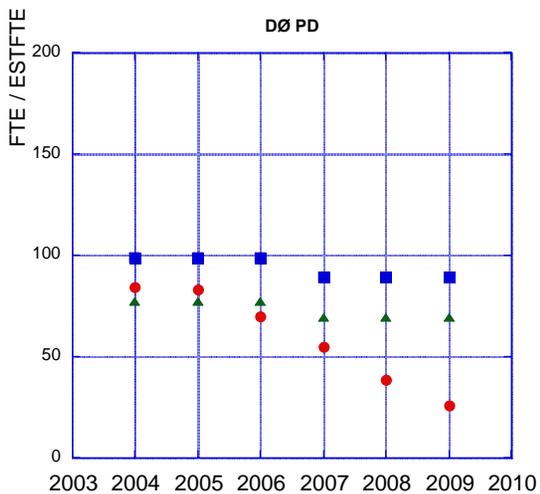
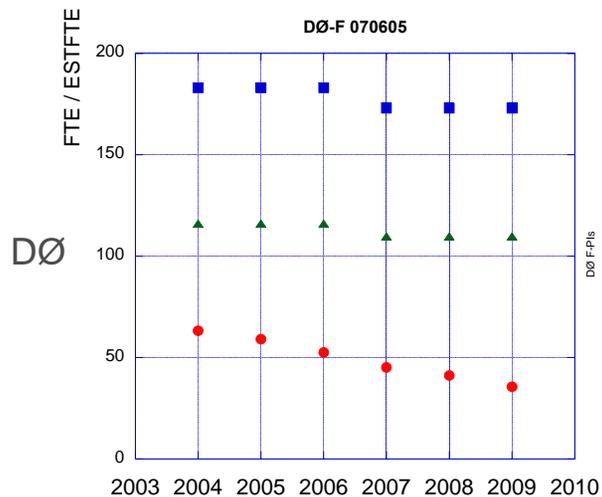
Total Personnel: CLEOc and BaBar SP and PI projections



CDF, DØ: total PI responses compared with Experiment Needs

■ total SP reported ▲ scaled to US-based SP

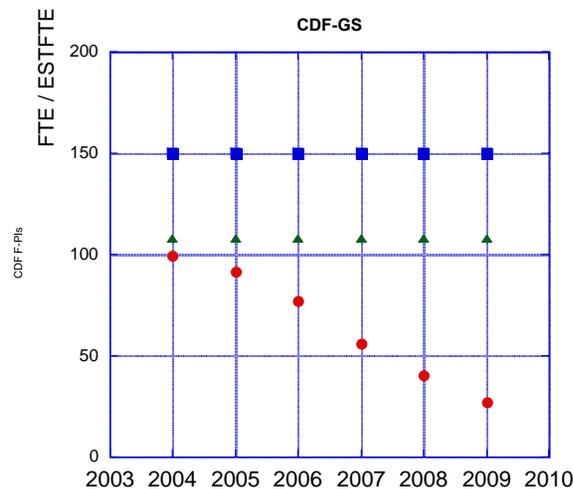
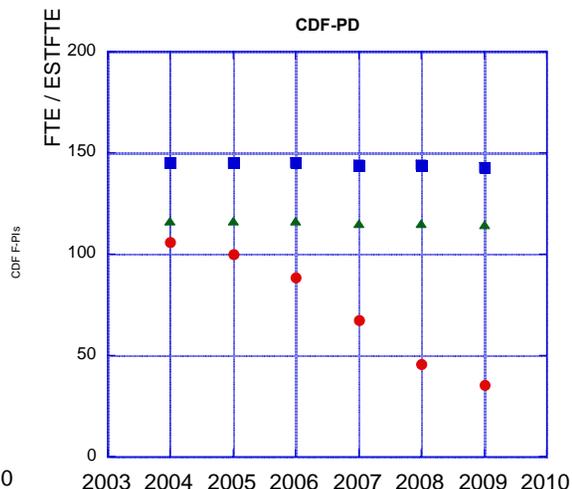
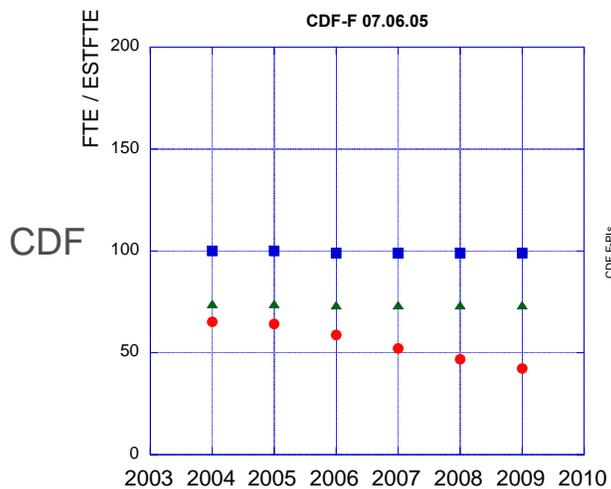
● US-based PI



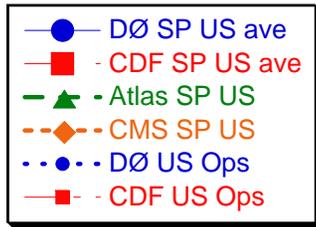
faculty/staff

post docs

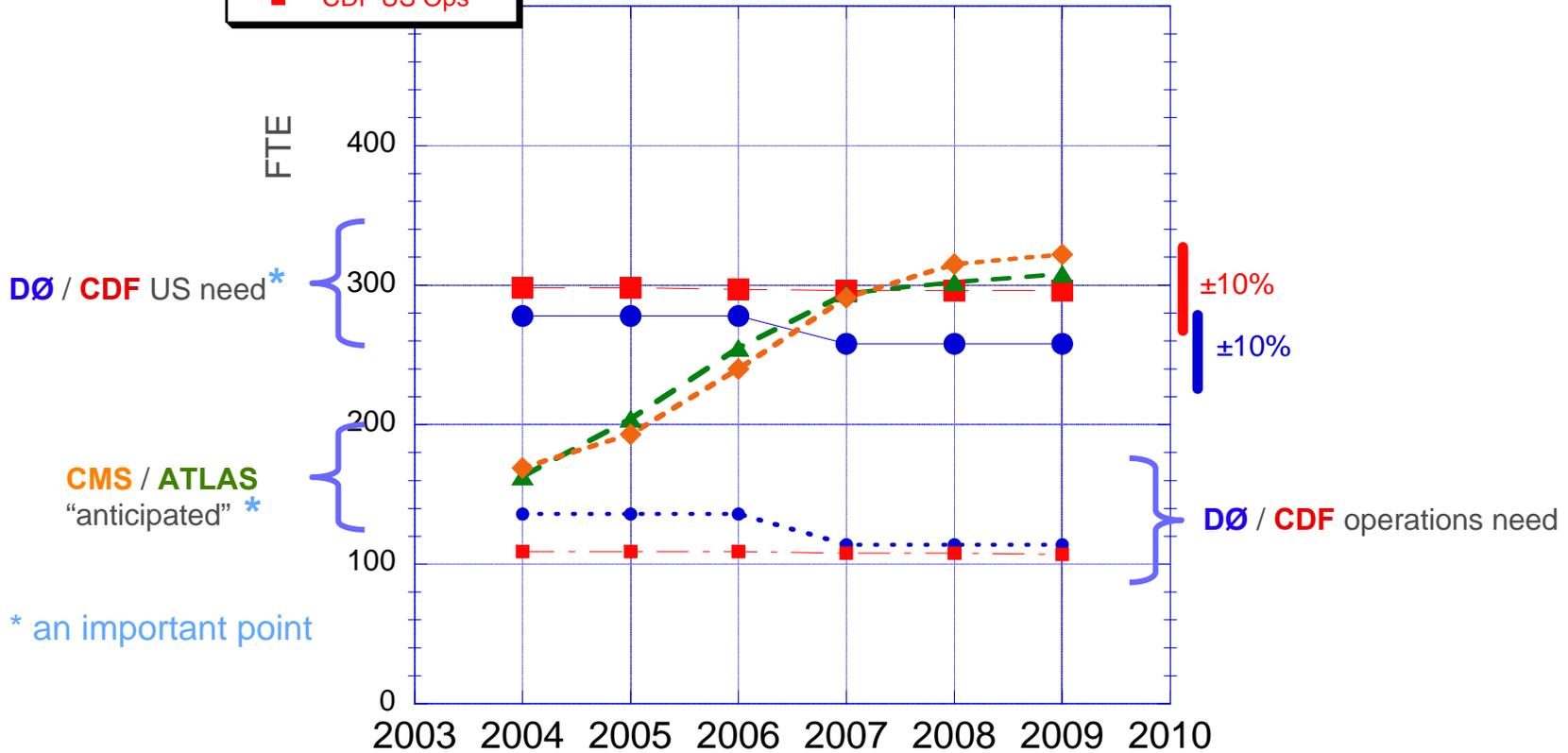
graduate students



DØ/CDF & ATLAS/CMS – SP “needs” ...updated



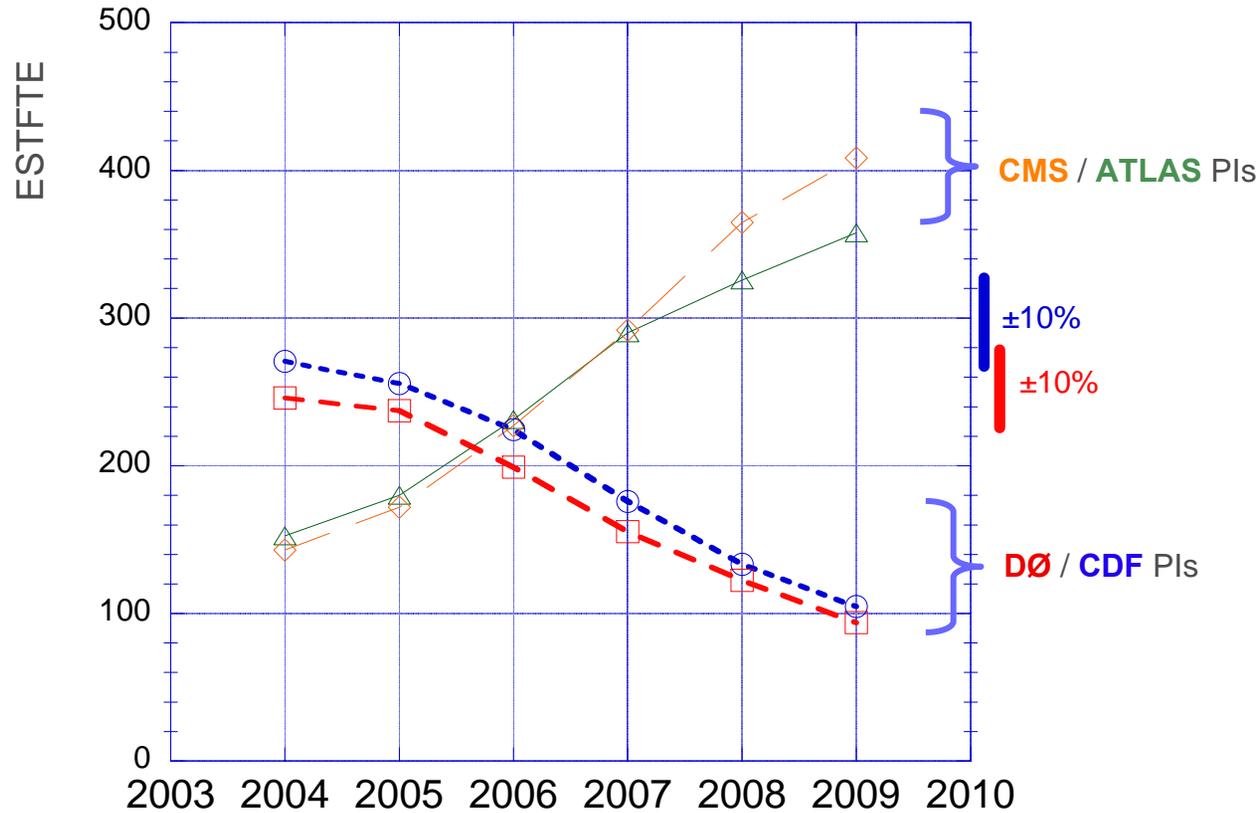
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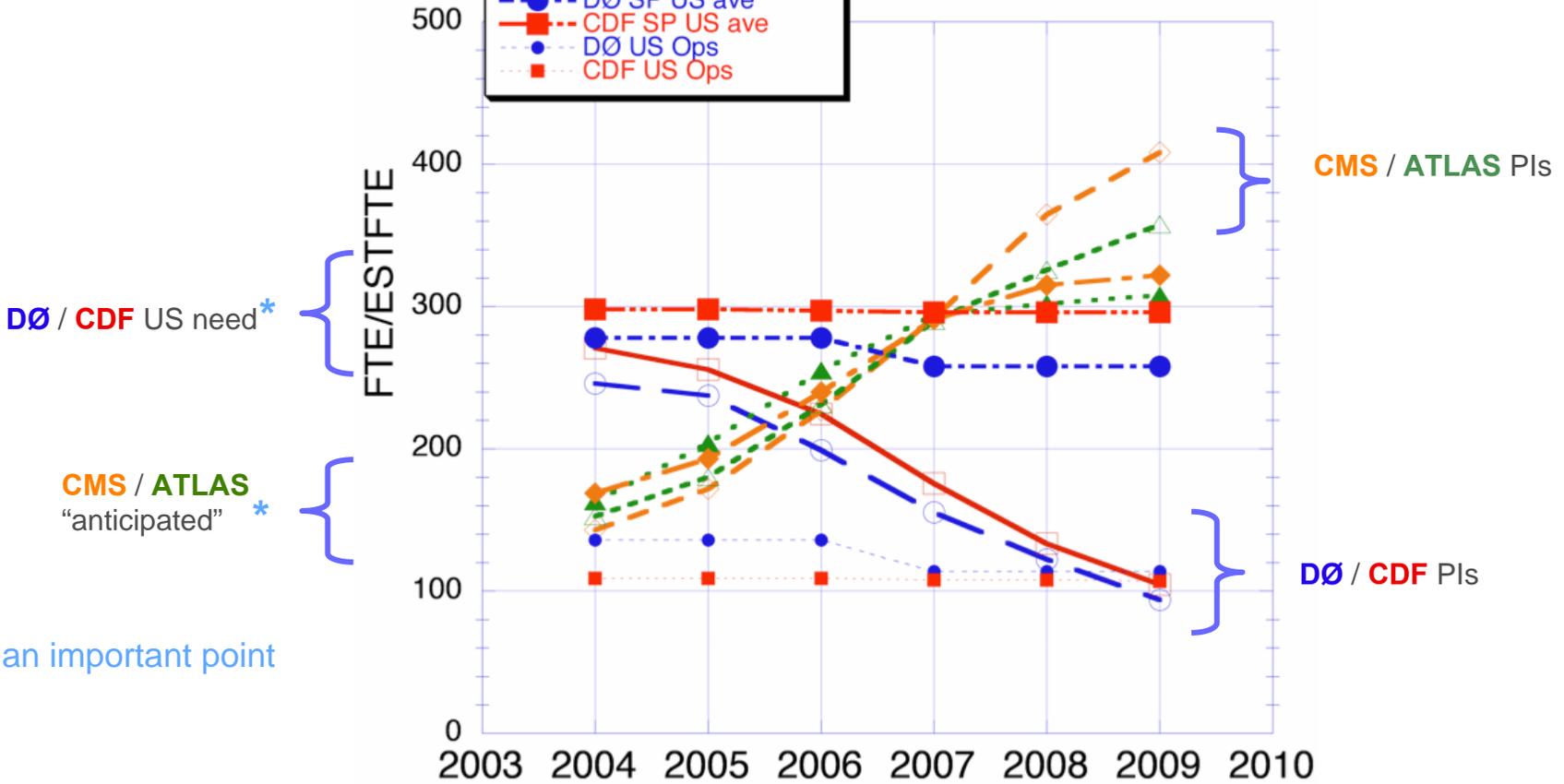
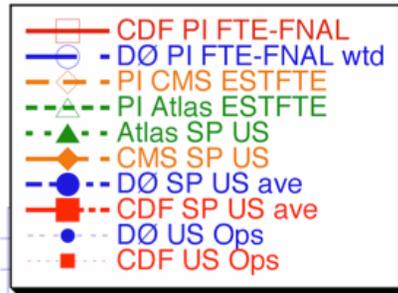
* an important point



total_collider_PI 070605



060905 4:19:56 PM 7/6/05



PIs in colliders...pretty much go to LHC

green: DØ+CDF+BaBar+CLEOc

orange: US ATLAS + US CMS

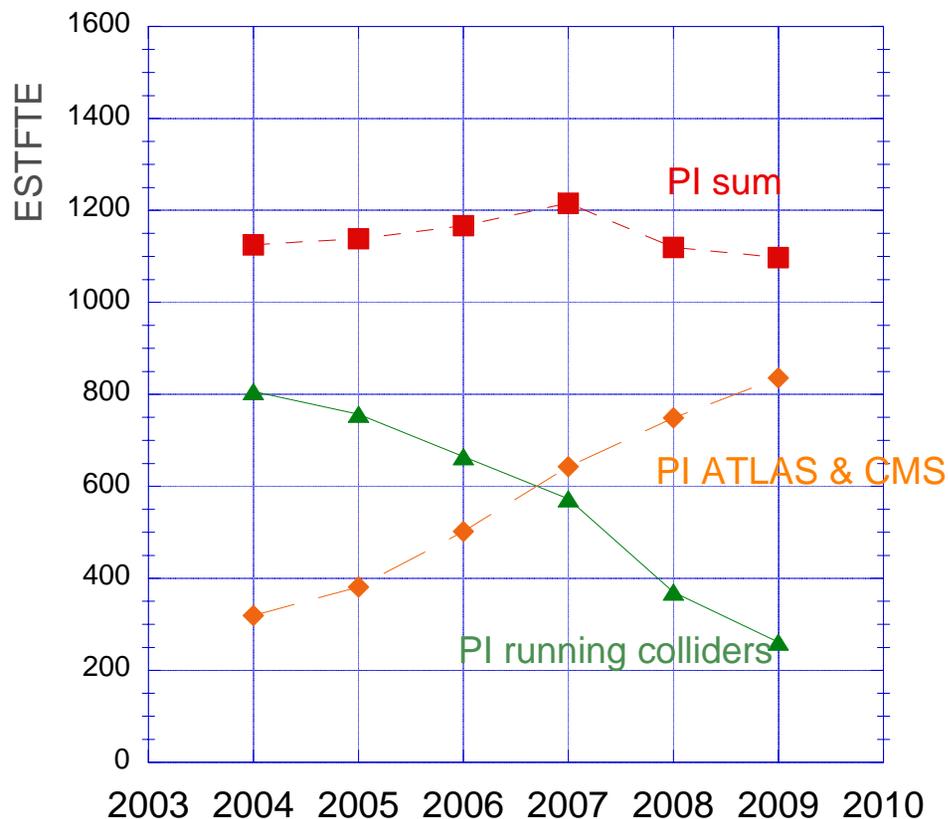
red: sum

observe:

- *within this sub-community, the PI's followed the constant-effort rules*
- *BaBar and CLEOc groups' migration to LHC is significant*



total_collider_PI_SP_060805 2:14:2 PM 6/8/05



Collider Spokespeople's "needs/anticipations"

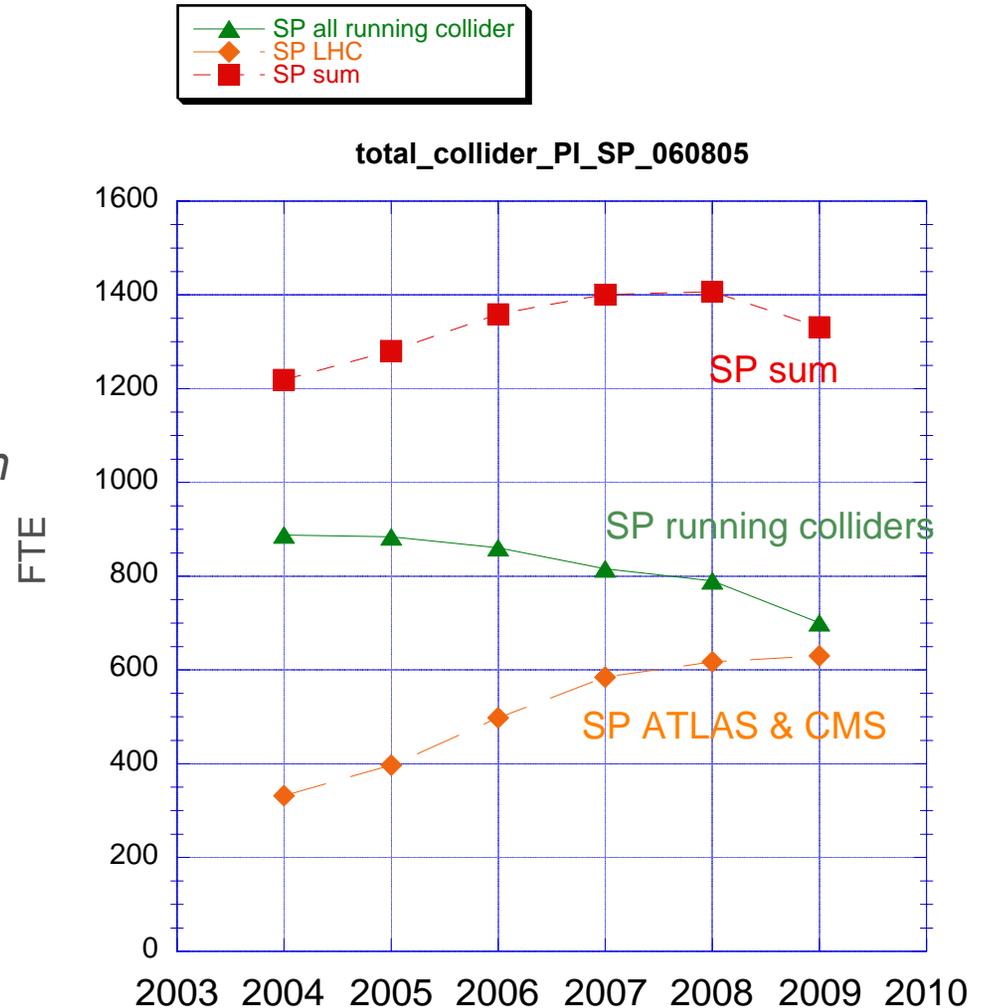
green: DØ+CDF+BaBar+CLEOc

orange: US ATLAS + US CMS

red: sum

observe?

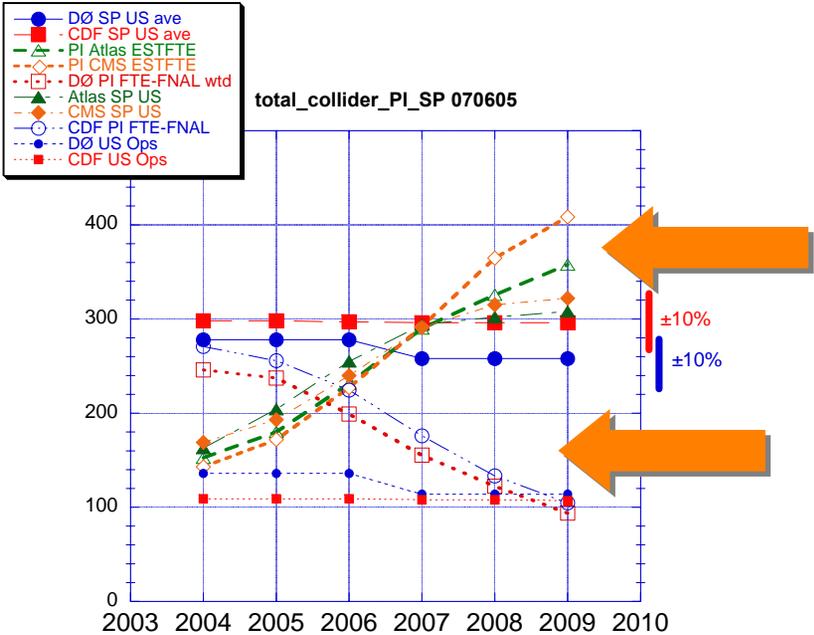
- "needs/anticipations" appear to rise in the 04-07 period that subsides as the electron-positron machines shut down



**the tevatron situation
appears to present special challenges**

therefore, there was a special follow-up in June 2005

focusing on the Tevatron situation



N.B. outyears are the result of huge extrapolation from 2005

Observations:

- An apparent correlation among ~80 independent DØ/CDF PIs
- A significant PI fall-off, especially > 2006
- The difficulty in defining “needs” by the experiments
- The almost certain...um...uncertainty in predicting ≥08 - unclamped beyond ‘04

NOTE:

- This is all theoretical - nothing has happened yet.
- It suggests a potential problem to be investigated.

Are these the real “needs” of the experiments?
 Are these the real “plans” of the PIs?
 “Constant Effort” rule was very difficult to contend with for PIs

the “face” on the numbers

DØ IB + CDF EB reps received a questionnaire that included the following questions for anonymous reply:

1. *Do these results surprise and/or concern you?*
2. *Would you have liked to have kept a greater presence in DØ or CDF during the 2006-9 period than your response suggested?*
3. *If you would have, what led to your decision to respond with a significant reduction in plans for CDF or DØ?*
4. *What factors influenced your projection to 2007?*
5. *What would you have needed to believe about your particular circumstances in order for you to have responded with a greater presence in DØ or CDF?*
6. *Should CDF and DØ collaborations just live with this apparent plan or should the tevatron community promote a managed transition? **Do you have a sense of what would constitute a managed transition?***
7. *Would these apparent results - especially #C and #D- have led you to have responded differently if you had known beforehand?*
(“#C and #D” refer to the PI projections: more-LHC than anticipated & fall off in Tevatron plans)

One DØ person reported back:

“One positive thing that I come away with is a greater sense of duty to DZero. I can't now assume that other groups will keep DZero running as we shift to CMS.”

Questionnaire - about half of DØ and CDF institutions responded by 7/1/05

Emphasized by all: Outstanding physics will come from the Tevatron

- *Redirection of physicist resources can compromise the physics*
- *Premature migration would prevent PD and GS from gaining the experience necessary for LHC analysis*

Two issues dominated any shift from Tevatron to LHC

- *Physics: some needing to participate in LHC on Day 1*
- *Some reported implicit and/or explicit directives from agencies to shift from Tevatron to LHC*

60% say “physics”; 45% say “pressure” (including 9% who say both)

The constant effort constraint:

- *was a reason for an apparent coherent response away from Tevatron*

65% said that, with incrementally more resources, they could devote additional students or postdocs to the Tevatron program

Small groups have a special problem

- *Essentially a binary, either-or decision*

Essentially all were in favor of a “managed” transition. Some suggested:

- *specific ideas for streamlining of operations, analysis, code changes*
- *more inclusion of Lab technical people into traditionally physicist roles*
- *prioritizing of physics goals*
- *the need for close coordination among stakeholders leading to a strategy*

and assurance that those who conformed would not suffer funding loss

Conclusions

Summary of the Conditions and Circumstances

Reminder: These responses were made in the framework of:

A constant level of effort from the PI's

They were done in the context of time-dependent uncertainties:

- 1. Potential for exciting physics results*
- 2. Uncertainty in the LHC schedule*
- 3. The uncertainty of Tevatron and B-factory luminosity future performance*

Called the “3 uncertainties” for the following...

Summary/Conclusions from this exercise

- **The committee concludes that maximizing the physics return from the Tevatron and BaBar while simultaneously preparing for an active US role in ATLAS and CMS may tax physicist resources of the US HEP community.**
 - *Including the other efforts planned and underway in neutrino physics, astrophysics, cosmology, and cosmic ray physics.*
- **With respect to the Tevatron and LHC, the next 2 years will be crucial in terms of understanding the evolution of the “3 uncertainties” of the previous slide, but the field cannot wait to see whether this will prove to be the case.**
- **Although we cannot be sure that additional resources will be required, navigating this transition will require an unprecedented, active coordination among a) the running collider experiments (primarily, BaBar, DØ, and CDF), b) their lab managements, c) US ATLAS and US CMS, and d) the agencies in order to ensure it does not become a real problem**
 - *The Tevatron presents special challenges: There might be a serious problem at the Tevatron beginning within 1-2 years for those groups trying to evolve to LHC while simultaneously maintaining sufficient strength in CDF and DØ. (For BaBar, this situation appears to be less severe at this point.)*
 - *A focused effort on helping to maintain the Tevatron & B-factory efforts of a small number of specialized groups/personnel may be required in order to alleviate potential problems...if necessary, a few-year supplement to University Program budget could be required*
- **This coordination should start immediately and conclusions be reached in a matter of a few months in order that plans can be formulated and remedies negotiated very soon.**